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THE
ONTARIO WATER RESOURCES
COMMISSION

REPORT ON

WATER RESOURCES AND STREAM
POLLUTION SURVEY OF THE
*LAKEHEAD AREA
WITH RECOMMENDED PROGRAMS

*Lakehead Area in this report
includes the cities of Port Arthur and Fort William, and
the townships of Shuniah,
Neebing, Oliver and Paipoonge.

SURFACE WATER BRANCH

APRIL 1959

ONTARIO WATER
RESOURCES COMMISSION

PARLIAMENT BUILDINGS - TORONTO

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April 1959

PARLIAMENT BUILDINGS

TORONTO

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Neebing-	Mr.A.Grant, Reeve Miss H.M.Hewitt, Clerk-Treasurer Mr.E.Baker, Assessor
Paipoonge-	Mr.J.Vibert, Reeve
Oliver-	Mr.E.J.Weeks, Reeve
The Lakehead Planning Board	Mr.N.Dant, Director
Northwestern Ontario Development Association	Mr.A.Phillips, General Manager

WATER RESOURCES SURVEY

LAKEHEAD AREA

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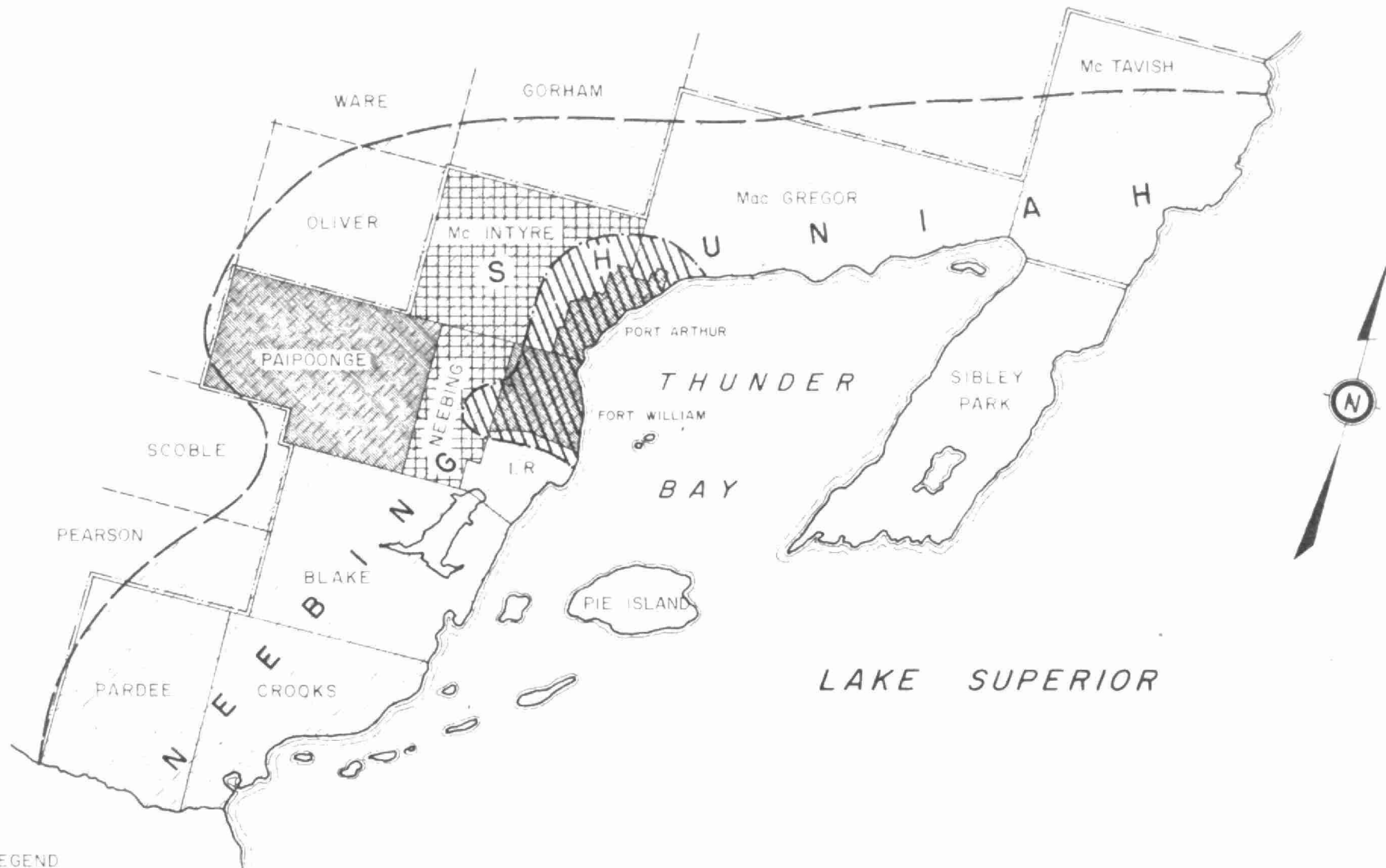
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SCALE : 1 Inch = 8 Miles (Approx.)

WATER RESOURCES SURVEY

LAKEHEAD AREA

SUMMARY AND RECOMMENDATIONS

I Summary

This report is based on a preliminary survey of water supply and general pollution in the Lakehead area. The Lakehead area in this report includes Fort William, Fort Arthur, and the municipalities of Shuniah and Neebing, and the townships of Oliver and Paipoonge. The information was obtained from municipal officials and staffs, sewerage reports by consulting engineers, various reports by the Commission including the recent industrial waste survey and limited sampling during this survey.

For informative purposes, it should be stated that the municipality of Shuniah is comprised of the geographic townships of MacGregor, McTavish and McIntyre and the islands in front of MacGregor and McTavish. Also the municipality of Neebing is made up of part of the geographic township of Neebing and the geographic townships of Blake, Crooks, Pardee and part of Indian Reserve No.52.

The survey indicates the need for additional work in the area which will involve an over-all pollution survey of the watercourses and Thunder Bay, including more detailed studies of the best alternative source of water supply for Fort William. It points to the need for a concentrated, co-operative effort between the pulp and paper industry and this Commission toward the development of an economical and satisfactory method of treating the waste from the industry's plants. It is noted that the waste from the four pulp and paper mills in the

area has an oxygen demand equivalent to the sewage from a population of 1,236,600. This is based on the Five-Day Biochemical Oxygen Demand of the waste.

On the basis of the limited well records that are available and the experience of the local population, it is felt that ground water cannot be considered as a suitable source of supply for any concentrated development in the area. This source can only be considered satisfactory for isolated homes.

The two sources of future surface water supply in the area will be Lake Superior or the Kaministiquia River. Either source will give an adequate quantity of good quality water for municipal purposes. Considering the raw water in its natural state, Lake Superior would supply the better water in view of its greater uniformity of quality throughout the year and its lack of colour. In addition, a supply from the Kaministiquia River would require a full treatment plant, whereas a properly located intake on Lake Superior would provide water which would require minimal treatment. However, with properly designed works, both sources can produce water of high quality. The decision will therefore be based on cost to a considerable extent.

The other watercourses in the area do not have sufficient year-round flow for their development as a municipal supply. For this same reason they cannot be considered as effective for receiving sewage treatment plant effluents without a high degree of treatment.

The high cost of servicing with water and sewers some of the residential developments in McIntyre points to the need for careful future planning. The estimated average cost per foot for installing six-inch water mains in this township is two to three times that in most other areas. This is due in large part to the frequency of rock

outcrops in the area. Also, in any municipality there is a need to balance residential with commercial and industrial growth. If this is not done the cost of servicing the area places a heavy tax burden on the individual home owners.

The cost of water and sewer services in Neebing is much lower than for McIntyre due to better soil conditions. However, for economical growth there is also a need for control of residential development. For this reason there should be municipal bylaws which would prohibit residential development in both Neebing and McIntyre townships unless water and sewers are available or can be economically installed. Fort William and Port Arthur now have such bylaws. If some such control is not exercised in the outlying areas the servicing problems created will have uneconomical solutions.

It is expected that in the future much industrial development will occur along the waterfront. With a view to economical water and sewage services it is especially important that all large water users be located in this area. Port Arthur and Fort William are in a good position for this, in that there are over 4,000 acres of available industrial land, on or near the waterfront. Also to be considered is the protection from pollution of present and possible future water supplies from Lake Superior. This will involve adequate treatment facilities for present residential and industrial development and close supervision and control of the future developments.

In summary, for the Port Arthur and Fort William area, water is not a question of supply but rather of location of heavy water consumers and the maintaining of the quality of the source.

The carrying out of the recommendations contained in the sewerage report for Port Arthur by its consulting engineer will do much to improve sanitary conditions in the area. The capacity of the trunk

sewer will only be sufficient for serving the land within the city. The treatment plant will be built in stages with an initial primary treatment capacity for 20,000 people and an ultimate capacity of 80,000 people. The capacity of both the trunk sewer and the treatment plant is based on the removal of present storm water connections to sanitary sewers. The complete and economical utilization of the proposed sewerage system for Port Arthur will depend on the removal of present storm water connections and the prevention of this water from entering the sanitary sewers in the future.

The sewerage report for Fort William by its consulting engineer proposes a system which will greatly improve the sanitary conditions in the area of the city. The interceptor sewers will be designed to take 2.75 times the dry weather flow of the present combined sewers. It will provide a plant with an initial primary treatment capacity of 12,500,000 gallons daily or for a population of 75,000 and a maximum of 30,000,000 gallons daily. In addition, these facilities are designed to receive ultimately the sewage flow from 1,200 acres of McIntyre Township with an estimated population of 18,000 persons.

Large central water and sewage treatment plants are in general more economical to operate than a number of small local ones. In addition, in the case of water there is the possibility of failure of the source of supply, pumping equipment, or breaks in the larger feeder mains. This latter possibility has occurred in the past in Fort William. Such conditions make it desirable for integration of water and sewer services where it is economically feasible. It is felt that the lakehead area could profit by such an integration.

II Recommendations

1. Consideration should be given to the integration of water and

sewer systems in Port Arthur, Fort William, and the Townships of Neebing and McIntyre. The implementation of this plan might be considered in stages. The initial stage would be the integration of these systems for Port Arthur and McIntyre on one hand and Fort William, Neebing, McIntyre on the other hand.

2. Where feasible, consideration should be given to joint sewage treatment facilities for these municipalities.

3. Industries which are large water consumers should to advantage continue to be located near the waterfront.

Fort William

4. A supplementary source of water supply should be considered.

5. The sewerage plan recommended by the city's consulting engineer should be implemented as soon as possible.

6. A satisfactory method of treating waste from Great Lakes Paper Company Limited, Abitibi Power and Paper Company Limited, Fort William Division, Ogilvie Flour Mills Limited and Husky Oil and Refining Company Limited, should be developed as soon as possible.

7. If possible, agreements should be reached for receiving sewage from future developments both in McIntyre and Neebing Townships.

Port Arthur

8. If the micro-strainer which is presently being tested by the city proves to be beneficial in removing gross suspended solids from the water supply, these units should be installed at the pumping station. An ultimate objective for removal of turbidity and finer particles would be the installation of filters.

9. The water distribution system should be reinforced with more large diameter feeder mains and elevated storage.

10. The sewerage program outlined in the report by the city's consulting engineer should be implemented as soon as possible. Among

other things this will involve the elimination and prevention in the future of storm water from the sanitary sewers and the development of a separate storm water sewer system.

11. The trunk sewers should be designed to receive sewage from some of the future developments in McIntyre Township.

12. A satisfactory method of treating waste from Abitibi Power and Paper Company, Limited, Thunder Bay Division, the Provincial Paper Company, and Northern Wood Preservers Limited should be developed as soon as possible.

13. A thorough investigation should be made of the large amount of non-revenue water (45%), which is pumped.

Municipality of Shuniah

The following recommendations deal with the Township of McIntyre:

14. Basic water supply and sewer agreements should be made between McIntyre and the City of Port Arthur and between the township and Fort William.

15. The township should pass a bylaw which would prohibit residential development unless water and sewage services are available or can be economically installed.

16. The sewage in the south-east portion of the township, including Jumbo Gardens, should be drained to a trunk sewer which in general would follow the valley of the McIntyre River. A temporary measure, if economical, would be the construction of a small complete treatment sewage plant which would receive and treat this flow until such time as the trunk sewer was installed.

17. The sewage from the north-east section of the township should be directed south to the Port Arthur sewers.

Municipality of Neebing

The following recommendations deal with the Township of Neebing:

18. Basic water and sewer agreements should be made between Neebing Township and the City of Fort William.
19. Consideration should be given to installing water mains on Broadway, Rosslyn road and Arthur street. This should be a staged development and will depend on the satisfactory completion of the agreement outlined in "Recommendation #18".
20. The township should pass a bylaw which would prohibit residential development unless sewer and water services are available or can be economically installed.
21. All sewage should be directed to the proposed Fort William sewage treatment plant. If this is not possible consideration will have to be given to the eventual construction of a sewage treatment plant, which would be located on the Kaministiquia River, near the east boundary of the township.

Township of Paipoonge

22. If the private wells in the area become contaminated by drainage from septic tank systems, then a central sewage system should be developed. The most economical form of treatment would be by means of an oxidation lagoon.

GEOGRAPHY AND GEOLOGY

I Geography

(1) Topography

The Lakehead area can be divided into two sections with distinct physical differences. The delta which is a large triangular shaped plain with an eight-mile north-south base along Lake Superior. The base begins at McNab Point some five miles south of Fort William and extends north to a point opposite the centre of Port Arthur. The south-west side is bounded for the most part by the high hills which contain Loch Lomond and extends to an apex located at the junction of north and south branches of the Neebing River, just west of the Lakehead Airport. This apex is some six miles west of Lake Superior. There are approximately 27 square miles in the plain and it rises from the mean lake level at elevation 602 to the 650 foot contour. It contains all of Fort William, the south-east section of Port Arthur and small parts of Neebing and McIntyre Townships. Also located in the delta are the mouths of five rivers, i.e., Mission, McKellar, Kaministiquia, Neebing and McIntyre. The plain contains a relatively thick overburden on top of the bedrock.

The second section is composed of a series of terraces on which is located most of the City of Port Arthur. Generally in this area the bedrock is at or near the surface. The elevation in Port Arthur ranges from lake level elevation of 603 to the 900 foot contour which passes through the north section of the city.

(2) Drainage

The central Lakehead area is drained by seven main watercourses, all emptying into Thunder Bay on Lake Superior. These are, Current River, McVicar Creek, McIntyre River, Neebing River, Kaministiquia River, Mission River and McKellar River and can be noted on Figure 2.

The flow in all of these, with the exception of the Kaministikwia River, Mission River and McKellar River is quite low or non-existent during part of the year. There are hydro control dams on the upper part of the Kaministikwia River which regulate the flow.

The Kaministikwia River at its mouth splits into three watercourses. These are, in order from north to south, Kaministikwia River, McKellar River and Mission River. The three rivers form two islands, known as Island #1 and Island #2. Island #1 which is to the north contains 630 acres and Island #2 has 830 acres.

(3) Climate

The climate in general is moderated by the close proximity of the lake. The monthly average temperature in Port Arthur ranges between 7°F. in January to 63°F. in July.

The average annual precipitation for a 25 year period is approximately 30 inches.

(4) Economy

The Lakehead area being considered has a population of over 90,000. Some 80,000 people are located in the Cities of Port Arthur and Fort William, each having approximately the same population.

The area is approximately 1,000 miles from Toronto and 450 miles from Winnipeg. The important reason for much of its growth is the fact that it is the break point for rail and water transportation in an east-west direction. There are good harbour facilities in the area which handle 13,000,000 tons of shipping per year.

Much of the shipping and storage facilities are for grain from the prairie provinces and iron ore from the Steep Rock area. There are 39 grain elevators with a total capacity of 148,000,000 bushels.

In addition to the shipping industry the area contains four large pulp and paper plants. These have a capacity of 609,000 tons of newsprint per year and 125 tons of fine paper daily.

The largest manufacturing industry is the Canadian Car Company Limited which manufactures such products as buses and mine and ore cars. There also is a creosoting plant and an oil refinery.

There is a limited amount of farming in the area. However, agriculture is and will likely continue to be a minor industry.

II Geology

In general, bedrock is at or near the surface in most of the Lakehead area. The bedrock is known as Precambrian and is part of the Canadian Shield which is present in most of northern Ontario. There are small pockets of unconsolidated material present in some areas and in others it forms a thin cover over the underlying bedrock. This general feature, i.e., the closeness of the bedrock to the surface, has the effect of making costly the installations of water mains and sewers in the area. The only section where this condition does not prevail is in the delta area noted under Topography. In this area there is a relatively thick overburden which contains glacial and post glacial sands, silts and clays.

FORT WILLIAM

I Water Supply

(1) Sources

(a) ground water

The situation here is similar to that of Port Arthur in that adequate surface water supplies has made it unnecessary to search for ground water. Well information from the surrounding rural area indicates that ground water would not be a practical source of supply for this municipality.

(b) surface water

The present source of water supply for Fort William is Loch Lomond. The lake occupies some six square miles and has a watershed area of 30 square miles. It is located in Blake Township and the Fort William Indian Reserve and is 330 feet above the mean level of Lake Superior. Lake soundings have indicated average depths from 20 feet to 120 feet.

The water is of good quality in most respects both chemically and physically. The watershed is controlled by the City of Fort William. There is no habitation on the watershed, and access to it is restricted. For this reason no domestic or industrial pollution enters the water.

A chemical analysis of the water is noted in the following table:

<u>Constituent</u>	<u>Amount</u>
Colour	30 units
Alkalinity as CaCO ₃	18 parts per million
Silica	4.2 parts per million
Iron	0.0 " " "
Total Hardness	56.2 " " "
Calcium Hardness	27.5 " " "
Magnesium	28.7 " " "
Sulphates	6.6 " " "
Chlorides	8.5 " " "
Nitrates as NO ₃	0.5 " " "

While the above noted hardness is 56.2 parts per million, there is considerable variation in this depending on the time of the year. Another sample of this water indicated a hardness of 18 parts per million. These hardness readings are quite low, and while a water of this nature is desirable for washing purposes it has certain disadvantages in that it has a tendency to corrosive characteristics. Hard waters which are artificially softened are generally reduced to a hardness of 80 parts per million which is considered an optimum level.

The quantity of water available from this source has never been factually determined. Estimations have been made on the basis of average rainfall, anticipated run-off in the watershed, and intermittent gauge readings of the overflow at the Carp River dam. For this reason the actual quantity of water available on a sustained basis or yearly supply is not accurately known. This has resulted in much conjecture and discussion on this point over the years.

In 1912 T. Aird Murray, Consulting Engineer, submitted a report titled "Suggested Improvements to Water Supply for City of Fort William". The following points were noted from this report. The average overflow from the lake was 11,000,000 gallons daily based on the three driest years 1883 to 1912; maximum reading 70,000,000 gallons daily. These calculations were based on intermittent gaugings of the lake overflow. In addition, an overflow rate was calculated on the basis of an average rainfall of 30 inches per year. It was felt that 15 inches of this amount would be lost to evaporation. Most of the remainder would be available run-off, since very little would percolate through the soil due to the rocky nature of the watershed. Therefore on the assumption that 12 inches of precipitation would eventually reach the lake the average daily overflow would be 14,300,000 gallons.

On the basis of the above assumptions and calculations it was felt that Loch Lomond could be depended on to supply an average of 12,000,000 gallons daily. However, it was indicated that the only way of determining accurately the dependable average daily supply, would be by installing a recording type flow guage at the Carp River dam. This suggestion has never been carried out.

At present there are only two outlets from Loch Lomond, i.e., overflow at the Carp River dam or via the water pipe lines to Fort William. In recent years flow recording meters have been installed on the pipe lines to the city. Thus the flow going to the city is known, but the amount overflowing at the Carp River dam is not known. It has been reported that there has been no overflow at this dam in the last three years. Therefore all water entering Loch Lomond is now being used by the city, apart from evaporation and other losses. In addition, the normal water level of the lake dropped 16 inches in 1958. It is realized that most lake levels were low during the year. However, the lack of overflow for a three year period indicates the need for considering a supplementary source of water, if Fort William is to be adequately supplied as it continues its growth.

(2) Consumption

No pumps are necessary on the system as there is a gravity flow from Loch Lomond to Fort William. As previously noted flow recording meters have been installed in recent years on the pipe lines to the city. These meters have been inoperative at various times, and incomplete records are available on the flow for past years.

The present average consumption is 7,500,000 gallons per day. For the estimated consumer population of 42,400 this represents an average daily per capita consumption of 177 gallons. This per capita consumption is high as can be seen by comparing with the more normal

figure for Port Arthur of 111 gallons. The difference may be due in part to the small percentage of metered services in Fort William. Most of the industrial services are metered, but very few of the commercial and domestic consumers are metered.

Recently lawn watering restrictions were imposed during the summer months. This was in order to preserve adequate water pressures for fire fighting purposes. The maximum daily water consumption is 10,800,000 gallons, and it occurred in August of 1957.

Due to the lack of meters the daily water consumption of the various classes of water consumers is not known. Of the average daily consumption of 7,500,000 gallons, 3,200,000 gallons is metered and the remainder 4,300,000 gallons or 57% is sold on a flat rate. The grade of most of the city sewers is quite flat, and much water is used flushing them. Accordingly the percentage of water used for municipal purposes will be high.

The industrial water consumption is considered to be 35% of the total. The largest industrial consumer, the Great Lakes Paper Mill has an average daily consumption of 1,000,000 gallons and a recorded maximum of 2,600,000 gallons. This plant also has its own private supply which it obtains from the Kaministiquia River.

(3) Treatment

No treatment of the water is provided other than screening. As previously discussed the watershed area is controlled, and chlorination is not considered necessary. The intermittent presence of algae in the intermediate reservoir has posed a treatment problem. In the past this has been controlled by the use of copper sulphate. A permanent solution is being considered which would entail installing a roof over this reservoir. This will also prevent aerial pollution

of the water in the reservoir. In addition there is a limited taste problem in the spring due to the lake turn-over.

(4) Distribution

The Fort William water distribution system consists of 113 miles of mostly cast iron pipe, varying in diameter from four inches to 24 inches. Steel pipe is used in crossings under the river. The water is distributed to the city and to the following consumers in the Township of Neebing; 56 homes in the Stanley Park and Rosslyn Road area, the Neebing Municipal Building, Fort William Municipal Airport, the Canadian National Railway yards and the Great Lakes Paper Company Limited. There is a total of 11,664 services as follows:

	<u>Number</u>	<u>Percent</u>
Domestic	10,860	93%
Commercial	724	6%
Industrial	80	1%

The pressure in the city averages from 85 psi. to 110 psi. This is stabilized by the intermediate reservoir which when full has a head of 284 feet above the grade at Syndicate and Empire Avenue. Generally speaking there is no low pressure but some high pressure problems.

(5) Potential Alternative Supply

There are two potential alternative supplies for the city, i.e., the Kaministiquia River and Lake Superior. Both sources would provide a good quality water suitable for municipal purposes. Chemical analyses of both these supplies and Loch Lomond, are noted below:

<u>Constituent</u>	<u>Lake Superior</u>	<u>Kaministiquia River</u>	<u>Loch Lomond</u>
Colour	5 units	150 units	30 units
Alkalinity as CaCO ₃	38 p.p.m.	53 p.p.m.	18 p.p.m.

<u>Constituent</u>	<u>Lake Superior</u>	<u>Kaministikwia River</u>	<u>Loch Lomond</u>
Silica	6.5 p.p.m.	---	4.2 p.p.m.
Iron	0.1 p.p.m.	0.0 p.p.m.	0.0 p.p.m.
Total Hardness	57.8 p.p.m.	64.0 p.p.m.	56.2 p.p.m.
Calcium Hardness	39.3 p.p.m.	---	27.5 p.p.m.
Magnesium "	18.5 p.p.m.	---	28.7 p.p.m.
Sulphates	4.1 p.p.m.	---	6.6 p.p.m.
Chlorides	3.0 p.p.m.	12.0 p.p.m.	8.5 p.p.m.
Nitrate as NO ₃	1.0 p.p.m.	---	0.5 p.p.m.
Turbidity as SiO ₂	---	23 p.p.m.	---

Note: p.p.m. means parts per million.

The analyses indicate that both these sources are well within the accepted limits of standards for municipal water supplies. These waters compare favourably with the present supply, and from the point of quality uniformity the Lake Superior supply would exceed Loch Lomond.

A municipal supply from either source would require varying degrees of treatment. It is felt that with the proper location of an intake in Lake Superior a satisfactory water could be produced after screening and chlorination. However, due to colour and variable turbidity, it would be necessary to provide a complete water filtration plant in order to produce a satisfactory water from the Kaministikwia River. Complete water treatment consists essentially of screening, coagulation and mixing tanks, chemical feeding devices, settling tanks, filters and chlorination.

(a) Kaministikwia River Supply

Prior to the development of Loch Lomond the Kaministikwia River was one of the original water supplies for Fort William. The intake was located in the river at the foot of Sprague street. A boat travelling the river damaged the intake. Sewage subsequently entered the system which resulted in a typhoid fever epidemic in 1905 and 1906. This was one of the reasons for the beginning

of the construction of the works at Loch Lomond in 1906.

The Kaministiquia River drains the Shebandowan Lakes and Dog Lakes which are both approximately 40 miles north-west of Fort William. It has a total drainage area of some 2500 square miles. The upper reaches of the river have a number of falls and rapids. Flow from both lakes is controlled by Ontario Hydro storage dams. A Hydro generating station is located at Kakabeka Falls which is the last major falls going downstream.

The lower portion of the river from Point de Meuron to the mouth, some eight miles, has very little grade and is slow moving. There is a small rapids at Point de Meuron, and at times of high water level in Lake Superior the lake water backs up the river to this point. There are two pulp and paper mills on this lower portion of the river and a number of sewer outlets. At times of high water in Lake Superior wastes from these mills and outlets would be carried upstream as far as Point de Meuron. For this reason an intake on the river should be located upstream of the rapids at Point de Meuron.

There is a substantial flow in the Kaministiquia River, and it is quite fast in the upper and middle portions. Flow figures have been recorded at Kaministiquia, a point upstream from Kakabeka Falls since November 1925. During this period the following flows have been recorded:

Average	2,040 cfs.(29 years)
Minimum	370 cfs.(Mar.16,1931)
Maximum	20,300 cfs.(June 11, 1947)

Note: cfs. = cubic feet per second.

The minimum flow of 370 cfs. or 205,000,000 gallons daily indicates that this would be an adequate source for a municipal water supply. It can be expected that during periods of high flow there will

be varying degrees of turbidity and a need for maximum treatment. However, this is no real problem for an adequately designed water filtration plant.

An advantage of this source over Lake Superior would be the lower cost of intake facilities. This would be counteracted by the higher cost for complete treatment.

A plant located at Point de Meuron would be some six road miles from Central Fort William. Such a plant would be upstream of domestic and industrial waste from the city. There are some small villages upstream of this point, such as Rosslyn and Kakabeka Falls, but the amount of pollution from these would be negligible. The amounts and types of algae which would be present in this supply have not been investigated. Generally speaking the waters in this area are relatively sterile, i.e., with few nutrients for this type of growth. Due to the high minimum flow, it would not be necessary to impound the water to be assured of an adequate quantity at all times. This fact that the water would be continually flowing would lessen the possibility of troublesome aquatic growths. It is expected that a more comprehensive investigation of both sites can be made in the future.

(b) Lake Superior Supply

Lake Superior would be an unlimited supply of good quality water, but care should be taken in the location of the intake, so that it will not be subject to pollution from Fort William. For this reason it should be placed south of the mouth of the Mission River. The Abitibi Power and Paper Company Limited mill is located near the mouth of the Mission River. The necessary distance south of the Mission River can only be determined after float studies and

sampling are carried out in the area.

If the intake is located in a satisfactory depth of water then it should be possible to secure water relatively free of turbidity at all times. The only treatment required would be screening and chlorination. Contour maps indicates that a satisfactory depth of water can be secured close to shore at Whiskyjack Point or Grand Point. Whiskyjack Point is about one and one-half miles north of Grand Point and two and one-half miles south-east of the central part of Fort William. Deep water is closer to shore at Grand Point and it is farther from possible pollution carried by the Mission River. More investigation would be required before considering a location at either site.

II Water Needs

The present works at Loch Lomond consist of a 754 foot long intake with the mouth at a depth of some 40 feet. At the shore the water enters a 4 foot by 6 foot tunnel and flows for 4,819 feet to a forebay, which contains several sets of screens. From the forebay the water drains through one 18-inch diameter pipe and two 24-inch diameter pipes to a concrete reservoir. There is approximately a 30 foot drop from the mean water level in the lake to the reservoir and an additional 300 feet to the mean water level of Lake Superior. The water from the reservoir flows by gravity to the city distribution system via one 24-inch diameter pipe and two 18-inch diameter pipes.

The capacity of the constructed works is limited by the sizes of the pipes from the forebay to the reservoir. These have an estimated maximum capacity of 15,000,000 gallons daily. As previously discussed, the present demand is taxing the source to its limit.

The records of past consumption only cover a relatively

short time and due to meter failures are incomplete. Therefore, future water needs will be based on future population projections. In 1939 and 1958 the Fort William populations were respectively 24,843 and 41,791. This represents an increase of 68% in 20 years.

The present average daily per capita consumption is 177 gallons. The reasons for this high figure have been discussed. It is felt that the per capita consumption could be decreased considerably by the complete installation of meters.

In addition to the reasons previously discussed for this high figure there is the fact that water rates are relatively low.

The following is a copy of metered water rates:

Meter Water Rates Established

<u>UP TO</u>	<u>75,000 per quarter</u>	<u>25¢ per 1000 gallons</u>
75,000 to	125,000 per quarter	20¢ per 1000 gallons
125,000 "	250,000 " "	16 " " "
250,000 "	500,000 " "	15 " " "
500,000 "	1,000,000 " "	13 " " "
1,000,000 "	2,000,000 " "	11 " " "
2,000,000 "	4,000,000 " "	9 " " "
4,000,000 "	8,000,000 " "	8 " " "
8,000,000 "	20,000,000 " "	7 " " "
20,000,000 "	50,000,000 " "	6 " " "
50,000,000 "	And over	5 " " "

To which must be added a meter rental approximately ten (10%) per cent of the cost of installation.

In assessing future water needs there are factors which can alter the present per capita consumption. The complete installation of meters and the levying of costs on actual water usage should have a tendency to lower this figure. It should be noted that this would also delay the need for installing additional water supply works. When a new water system is constructed the cost of water and hence the selling price will increase considerably. This will be caused by the

need for constructing and maintaining a treatment plant with the necessary pumping, chemical and labour charges. These factors can lower the per capita water consumption in the future. On the other hand there is a general tendency for water consumption to increase due to the rising standard of living. The low cost of operating the present supply may always have the effect of maintaining an above average consumption.

On the basis of past population growth the anticipated population in the next 20 to 25 years will be 75,000. Future planning could be based on an average daily per capita consumption of 125 gallons. This will only be possible if the present high rate of 177 gallons is reduced. Using the reduced rate the projected average daily consumption by 1980 would be 9,500,000 gallons. In addition to the city demand the future water requirements of the townships of Neebing and McIntyre should be considered. It is estimated that the average daily water requirements of the Township of Neebing by 1980 will be 900,000 gallons. This is exclusive of the amount presently being supplied to the Great Lakes Paper Company. A preliminary examination indicates that it might be more economical to service the extreme south part of McIntyre Township with Fort William water. Thus, the total average daily water requirements for Fort William and the adjoining townships by 1980 would be 10,500,000 gallons.

It is estimated that Loch Lomond can supply water at the present average daily rate of 7,500,000 gallons. On this basis the design of a new plant should be predicated on supplying an average of 3,000,000 gallons daily.

Consideration should also be given to the future water requirements if consumption continues at the present average daily per

capita rate of 177 gallons. By 1980 with a city population of 75,000 the average daily demand would be 13,500,000 gallons and the total including the townships would amount to 14,500,000 gallons. The plant in this case would have to supply an average of 7,000,000 gallons daily.

Most of the industrial growth in the past has occurred in the south and east portion of the city, i.e., along the Kaministiquia River and on two islands formed at its mouth. There has also been some industrial development in the south-west portion of the city, i.e., west of James street, also in the north-east section near Balmoral street and Harold crescent.

It is expected that industries will continue to be located in these areas. The area along the Kaministiquia River and on the islands is ideal for the development of heavy industry. Water is accessible both for transportation and process purposes. In addition, the area is served by roads and rail.

It is expected that residential development will occur both south and north of the Neebing River. Planning officials feel that there is still some 1500 acres suitable for residential purposes in the city.

Extensions to the water distribution system are now being considered which will improve the supply to existing consumers and provide for much of the anticipated growth. It is proposed to extend a 24-inch diameter main north on James street which would improve pressure in the west end of the city and the area at the north end of Edward street. This will also provide water for the expected residential growth north of the Neebing River. At present Island #1, which is the southerly of the two islands at the mouth of the

Kaministikwia River, is supplied by a 16-inch diameter main. It is proposed to continue this line across this island to the Kaministikwia River. A 12-inch diameter line will be placed under the Kaministikwia and looped back into the distribution system on the mainland. These installations on Island #1 and #2 should provide for substantial industrial growth in the area.

There was a break in one of the mains across the Kaministikwia River in 1954, and it was necessary to draw some water from Port Arthur. Such instances point to the need for an integrated water distribution system. A more intensive survey might indicate that it is more economical to serve the extreme south end of Port Arthur with Fort William water.

III Water Pollution

The sewer system of Fort William is of the combined type, i.e., it carries both sanitary sewage and storm water. Approximately one-half of the sewage flow is carried by an interceptor sewer which is located along the south side of the Neebing River. This interceptor discharges to a primary treatment plant located on William street. The effluent from this plant flows to the Neebing River.

There is very little summer flow in the Neebing River, and in the last few miles the water level is the same as Lake Superior. There is also a tendency for silt to deposit at the river mouth. These conditions and the fact that the primary treatment plant is overloaded result in gross pollution at the lower portion of the river. To make matters worse, during periods of flood in the river many of the sewers back-up into the cellars. These carry sanitary waste as well as storm water, hence an unhealthy and objectionable condition is

created in many of the homes. This has been a cause for frequent complaints in the past.

As noted approximately one-half of the city sewage flow is discharged after partial treatment to the Neebing River. The remainder is discharged without treatment through 15 outlets to the Kaministiquia River. There are also several private sewers discharging into this river.

There is a small number of homes on Islands #1 and #2. These are serviced by individual septic tank systems. New residential development is not permitted on the islands as this area is to be conserved for industrial development.

The implementation of the recommendations contained in the sewerage report by the city's consulting engineer will result in satisfactory disposal of the present and future domestic waste from the city. Provision is also made for handling some of the industrial waste from the city and eventually sewage from that part of McIntyre Township north of the present city boundary.

No provision has been made in the above sewerage plan for treating wastes from the two pulp and paper mills. The two mills have a total population equivalent for their waste of 926,000 persons, that is the strength of waste from these two plants in oxygen requirements is equivalent to that from a domestic population of this number. The cost involved in treating ⁱⁿ a conventional plant a waste of this magnitude can be appreciated when it is compared to the \$1,500,000 cost of complete treatment for the estimated Fort William population of 75,000. However, the pulp and paper waste is differently constituted from domestic waste. For this reason a less costly form of effective treatment for this waste is being sought. With this view the pulp

and paper industry as a whole and the Commission can co-operate to advantage in a joint research effort.

The Great Lakes Paper Company Limited, is actually located on the Kaministiquia River in Neebing Township near the west boundary of Fort William. It has a capacity of 360,000 tons of newsprint per year. This is the largest of the four pulp and paper mills in the Lakehead. The estimated population equivalent of the plant waste, (based on 5 Day Biochemical Oxygen Demand) is 760,000.

The Abitibi Power and Paper Company Limited, Fort William Division, is located on Lake Superior at the mouth of the Mission River. It has an output of 115,600 tons of newsprint per year. The estimated population equivalent of the plant waste (based on 5 Day B.O.D.) is 166,000.

In addition to the pulp and paper mills the Ogilvie Flour Mills were found to be discharging a very strong waste. This plant waste has a population equivalent of 28,100 persons, based on a 5 Day Biochemical Oxygen Demand. The volume of waste is relatively small. For this reason it is felt that the waste from this plant might be eliminated by evaporation.

The waste from the Husky Oil and Refining Company Limited is presently being treated for oil removal. This plant also discharges varying amounts of phenol wastes. All wastes should be satisfactorily treated before being discharged to the receiving water.

An overall pollution study has never been undertaken in this area. However, the Commission has recently completed an industrial waste survey. It is anticipated that a more intensive general pollution survey will be carried out in the near future. It is known that the pulp and paper waste causes considerable pollution of the

lower Kaministikwia River, and this has been the cause for frequent complaints. It is felt that the implementation of the recommendations contained in the report by the city's consulting engineer will greatly improve the situation. This can be further improved by a method of satisfactorily treating the waste from the pulp and paper industry.

IV Recommendations for Water Development

In order to assure the city of an adequate quantity of water for future growth, consideration should be given to developing a new source of supply. The Kaministikwia River or Lake Superior would be suitable sources of supply. The new water development should be designed for supplying an average of, 3,000,000 gallons to, 7,000,000 gallons daily. As discussed this will depend on whether or not the daily per capita consumption is reduced from 177 gallons to 125 gallons.

The integration of the distribution system with the Port Arthur system would be beneficial both for the more economical serving of some areas and for the assurance of supply in times of main breakage or emergency.

V Recommendations for Pollution Control

In order to abate the unhealthy and objectionable conditions at the mouths of the Neebing and Kaministikwia Rivers and the waterfront, satisfactory sewage collecting and treating facilities should be constructed. This situation will be greatly improved by the implementation of the recommendations contained in the sewerage report by the city's consulting engineer. Also, individual action will need to be taken by some of the larger industries.

PORT ARTHUR

I Water Supply

(1) Sources

(a) ground water

Due to the adequate supply of surface water in the area it has not been necessary for the municipality to investigate ground water conditions in the area. Experience gained from rural wells indicate the ground water can not be considered as a practical source for a municipal supply.

(b) surface water

The water supply for Port Arthur is obtained from Lake Superior. This is an adequate supply, and in its natural condition is of excellent quality. Originally the intake was located in Lake Superior near the mouth of the Current River. This was abandoned some years ago due to the proximity of domestic sewage outfalls and the periodic high turbidities caused by flooding in the Current River. The present intakes and pumping station are at the north boundary of the city. There are two intakes which extend 2,400 feet from the shore with their mouths located in 45 foot depth of water.

The chemical constituents of the water are all within the desirable limits for a public water supply. It has an average hardness of 55 parts per million which is the lowest of the Great Lakes water. The hardness increases progressively downstream in the Great Lakes and reaches some 150 parts per million in Lake Ontario. A low hardness makes water more desirable for most domestic and many industrial uses.

The physical properties of this water are also good. The temperature varies between 31°F. and 64°F. A below freezing temperature is made possible due to flowing conditions.

(2) Pumpage

There are four electrically driven high lift pumps at the water pumping station, having a total capacity of 10,500,000 gallons daily. No gasoline or diesel standby power is available, but electricity is supplied from three sources. In addition to the main station pumps, there are three electrically driven pumps which draw from the centrally located 2,000,000 gallons of surface reservoir. These have a total daily capacity of 4,630,000 gallons.

The average and maximum daily consumption for the year 1957 are respectively, 4,400,000 gallons and 7,500,000 gallons. On the basis of the 1957 population this represents an average daily per capita consumption of 111 gallons.

For the year 1955 a total of 1,595,000,000 gallons was pumped, and revenue was received from 875,000,000 gallons. The difference of 720,000,000 gallons or 45% was used for street washing, sewer flushing, fire fighting, leakage and incidental municipal use. It is felt that 45% is a large amount for unaccounted water.

The sold water for 1955 was distributed in the following manner:

<u>Purpose</u>	<u>Amount</u>	<u>Percentage</u>
Domestic	375,000,000 gallons	43%
Commercial	262,000,000 "	30%
Industrial	238,000,000 "	27%

The total water pumped in 1955 was distributed as follows:

<u>Purpose</u>	<u>Amount</u>	<u>Percentage</u>
Domestic	375,000,000 gallons	24%
Commercial	262,000,000 "	16%
Industrial	238,000,000 "	15%
Public and Other	<u>720,000,000 "</u>	45%
	1,595,000,000	

The percentage distribution figures for 1955 would apply equally well for 1958.

(3) Treatment

Present treatment consists of coarse screening and chlorination. The limited treatment has been possible due to the previously mentioned good quality of the raw water in its natural state. However, due to the large scale operation of paper mills in the area there has arisen the problem of wood fibre in the water. This material has a tendency to accumulate on the inside of the water pipes. Sudden changes in water velocity causes the material to slough off and be discharged from taps with subsequent complaints from water consumers.

In order to overcome this problem of wood fibre, consideration has been given to installing some form of filters. At present pilot studies are being undertaken with a micro-strainer at the water pumping station. The micro-strainer is a revolving screen type of strainer with very fine openings in the stainless steel mesh. Initial results from this study indicates that this method of treatment should prove to be both efficient and economical.

(4) Distribution

The Port Arthur Public Utilities Commission distributes water to the city and a negligible amount to the Municipality of Shuniah. The water is made available to residents of Shuniah at five tap houses which are located near the city boundary.

The distribution system contains 111 miles of cast iron and steel pipe varying in diameter from 4 inch to 24 inch and 800 hydrants. There is also a surface reservoir and an elevated tank. The surface reservoir has a capacity of 2,000,000 gallons and is situated on Duke street which is a centrally located high area in the city. Water is pumped from this reservoir by means of three electrically driven pumps. The elevated tank has a capacity of 200,000 gallons and is located in the north-east section of the city on Grenville avenue.

At present there are some 9800 services of which 5400 are metered. It was estimated that 90% of the 650 industrial and commercial services are metered. Meters are being installed on the existing flat rate services, and eventually the system will be 100% metered.

A very large percentage of the distribution system is composed of six inch diameter pipe with few large feeder mains. As a result of this there are some areas of low pressure during periods of high consumption. The extreme south end and west end of the distribution system have a low pressure problem.

(5) Potential Alternative Supply

(a) ground water

As has been discussed under source, ground water in this area is not a practical source of water for urban development.

(b) surface water

The only economically feasible alternative source of surface water for Port Arthur would be the Current River. At present the city has a small dam and reservoir on this river, which is used for producing electrical power. The reservoir is some 150 acres and has been developed as a recreational park and bathing area.

The flow in the river during part of the year is quite low. Rivers of this size when they are dammed and become quiescent have a tendency to aid the development of algae and other aquatic life. These organisms can become quite troublesome to a water treatment plant as they produce tastes, odours and clog the filters. During times of storm the turbidity in the river water would be high, and complete treatment would be required if this water was to be used as a municipal supply. The complete treatment would consist of screening, coagulation with alum filtering, chlorination and other chemical treatment for controlling

tastes and odours if necessary.

The chemical quality of the water was not determined, but information on other rivers in the area indicate that from this point of view it would be quite acceptable as a municipal water supply.

The only advantage to using the Current River rather than Lake Superior as a source of water supply would be its freedom from industrial and domestic pollution.

II Water Needs

It is difficult to forecast the future population or water consumption of a municipality at any fixed date. Water development plans should be based on the envisaged needs of the next 20 or 25 years. For this purpose the following table of population growth and water demands over the last 20 years should be noted:

Year	<u>Population</u>		<u>Services</u>		<u>Average Daily Consumption</u>		<u>Average Daily per capita cons.</u>	
	<u>Number</u>	<u>% Incr.</u>	<u>Number</u>	<u>% Incr.</u>	<u>Gals.</u>	<u>% Incr.</u>	<u>Gals.</u>	<u>% Incr.</u>
1938	21,449	0	4459	0	2,660,000	0	124	0
1948	30,075	40%	6750	51%	3,360,000	26%	112	-10%
1957	39,621	85%	9799	120%	4,400,000	66%	111	-10%

Note: % Increase in all cases is based on the year 1938.

From the above it is seen that the only decrease has been in the average daily per capita water consumption. This is attributed to the change in water needs of some of the large industrial consumers. In most other cities the reverse is true, and there has been a gradual increase in the average daily per capita water consumption. It is felt that in the future Port Arthur will experience the same trend.

There are approximately 15 miles of waterfront in Port Arthur. In the past most of the large industrial water users, such as the pulp and paper mills, have located along the waterfront. These industries generally obtain their process water directly from Lake Superior. As these industries consume large quantities of process water it would be

quite expensive to pump the water via long pipe lines from a municipal water plant. It is suggested that this practice be encouraged in the future development of the city, i.e., large water consumers should be located along the waterfront.

A large segment of the present industry is of the dry type, where little or no process water is used. Examples of this are the grain and ore shipping enterprises and the necessary warehouse facilities. The city is hopeful of attracting a more varied type of industry in the future. As noted above large industrial water users should be located along the waterfront where they can obtain their own water directly from Lake Superior. In view of this, future water needs can be projected more readily by basing it on the anticipated population growth.

The population increase of Port Arthur in the 20 year period from 1938 to 1957 was 85%. On this basis the population may be expected to double in the next 20 to 25 years. Accordingly water works plans should be based on supplying an average of 9,000,000 gallons daily by 1980.

The present pumping station has a maximum pumping capacity of 10,500,000 gallons per day. The capacity of the intakes is estimated to be 18,000,000 gallons daily. The pumps at the 2,000,000 gallon surface reservoir are rated at 4,630,000 gallons daily. The pumping capacity appears to be adequate for the immediate future.

Future residential growth will likely occur in the west and north-west sections of the city. Most of the industrial growth should take place in the south end of the municipality where there is available some 2600 acres.

In order to serve the expected area of residential growth and to alleviate existing pressure problems a feeder main should be laid around the north end of the city and an additional elevated tank installed. This would also be useful in supplying the Municipality of Shuniah.

At present a 16-inch diameter feeder main located along Algoma street is terminated at Bay street. An extension of this main would serve the anticipated industrial growth in the south end of the city and also solve the problem of low pressure in this area.

In general, the distribution system is in need of reinforcement by large diameter feeder mains and elevated storage. This should be based on the elimination of existing low pressure areas and the provision of an adequate system to serve the expected areas of growth both within Port Arthur and the surrounding Municipality of Shuniah.

III Water Pollution

At present, raw and partially treated domestic sewage and industrial wastes are discharged to the harbour area. These wastes are discharged by five municipal sewers and a number of private sewers. The municipal outlets are located at John street, Wilson street, the mouth of McVicar Creek, Clarke street and Lillian street. They are noted on Figure 3.

The Lillian street sewer serves the Current River area, and all waste from this receives primary settling before being discharged to Thunder Bay. This system is overloaded and has been the cause of complaints in the past. Special consideration has been given to the outlet in the past as it is the closest one to the city water intake.

A sewerage report for the city has been prepared by a firm of consulting engineers. The report recommends a three-stage development

in building a primary treatment plant and a trunk sewer and necessary pumping stations to collect all flows from the existing five municipal outlets. The design is based on serving an ultimate area in the municipality of 6100 acres with an expected population of 79,500. No provision has been made for receiving any flow from the surrounding Municipality of Shuniah.

At present there are many storm water connections to the sewers. The present excess capacity of the proposed trunk sanitary sewer will be used to a large extent by existing storm water flows. In order for this sewer to carry sanitary flows from future developments, these storm water connections will have to be disconnected and a separate storm sewer system installed.

The present sewerage programme is based primarily on the collection and treatment of domestic waste. It is expected that the waste flow from some industries will be accepted to the treatment plant. This will depend on volume of flow and the strength of waste. In view of this the largest industry in the area, i.e., pulp and paper will have to provide its own treatment.

There are two pulp and paper mills in Port Arthur. A recent industrial waste survey by the Commission indicates that the sewerage population equivalent of the waste flow from these two mills is equal to 310,600 persons, that is the waste from these two plants based on 5 Day Biochemical Oxygen Demand, has a strength equivalent to the total sewage flow from a domestic population of 310,600 persons. The magnitude and cost of works to treat this waste in a conventional plant can therefore be appreciated when it is compared to the Port Arthur treatment plant which will initially serve 20,000 persons and cost \$600,000. It is of course realized that the pulp and paper

waste is different from domestic sewage in many respects. In view of this it is felt that a form of treatment differing from the conventional type should be attempted.

The Abitibi Power and Paper Company Limited, Thunder Bay Division, is located on Thunder Bay at the extreme east end of Port Arthur. The mill is approximately 1,000 feet south-west of the city water intake. The plant has a capacity of 133,000 tons of newsprint per year. A survey of wastes from the mill indicates it has a population equivalent of 187,600 persons based on 5 Day Biochemical Oxygen Demand.

The Provincial Paper Limited, is also located on Thunder Bay about one mile south-west of the city water intake. It has a plant capacity of 125 tons of fine paper per day. The strength of the plant waste has a population equivalent of 123,000 persons, based on the 5 Day Biochemical Oxygen Demand.

As previously discussed there is the problem of wood fibre in the Port Arthur water supply. In view of this, special steps should be taken by these two mills in arriving at an early solution for the treatment of process wastes.

The Northern Wood Preservers Limited, also discharge wastes to Thunder Bay. These wastes contain oil, phenol and wood fibre, which individually or collectively could interfere with the municipal water supply. Treatment of these wastes would include in part, oil separators and wood fibre settling tanks.

The extent of pollution in Thunder Bay has not been studied on an overall basis. Some complaints have been received in the past, and as previously discussed the wood fibre discharged by the pulp and paper plants, poses a treatment problem for the water works plant.

It is anticipated that a comprehensive sanitary survey of Thunder Bay can be undertaken in the near future.

IV Recommendations for Water Development

A satisfactory method of removing or excluding gross solids from the city water should be instituted as soon as possible. Present tests indicate that micro strainers may be the best means of dealing with this problem.

There is a need for installing more large feeder mains and elevated storage in the distribution system. This is to alleviate present low pressure problems and to provide for future growth.

Industries who are large water consumers should be encouraged to locate near the waterfront. This will provide for more economical water supply.

The present amount of pumped non-revenue water is high, i.e., 45%. An investigation might reveal that this is due to excessive leaks.

Consideration should be given to integrating the water distribution system of Fort William and Port Arthur. This will provide more economical service to some areas and be beneficial in cases of emergency.

V Recommendations for Pollution Control

The waterfront area is polluted by the five municipal and a number of private sewers which discharge to Thunder Bay. In order to abate this and protect the city water supply from pollution, it will be necessary to carry out the recommendations contained in the sewerage report, by the city's consulting engineer. This will involve the removal of storm water from the sanitary sewers and the development of a separate storm sewer system.

Sewage flow from some of the developments in McIntyre Township should ultimately be directed toward the Port Arthur system. The city should design their trunk sewers to receive this flow.

Plans will have to be developed by some of the individual industries for treating their wastes. The pulp and paper mills fall into this category.

MUNICIPALITY OF SHUNIAH

I Water Supply

The Municipality of Shuniah contains the geographical townships of MacGregor, McIntyre, and McTavish. Most of the concentrated population of this municipality is located in the townships of McIntyre and MacGregor. McIntyre contains the greatest population of the three. The development in MacGregor is mostly summer homes. There is no concentrated population centre in McTavish at present.

Most of the homes in MacGregor area are intended for summer use only, and are located in a strip along the shore of Lake Superior to the east of Port Arthur. The homes here either obtain water from wells or directly from the lake. There are reported to be some artesian wells in the area. Generally speaking there are no water or pollution problems in McTavish Township.

In McIntyre Township there are two main areas of development. One is known as Jumbo Gardens, located on the west central boundary of Port Arthur. The other is the Oliver Road and Central or Twelfth avenue area. This latter section is on the south-westerly boundary of Port Arthur. It is estimated that there are some 1,500 persons in Jumbo Gardens and 500 persons in the Oliver road and Central avenue area.

The present water supply for McIntyre Township is from wells, both drilled and dug. These wells have only sufficient capacity for supplying individual homes. There are no well records to indicate supplies that would be sufficient for any large built-up area. Recently many of these wells have gone dry, and it has been necessary to drill deeper in search for a better water supply. On the whole the results have not been too promising.

Some of the water used in this township is obtained from the

five tap houses which are located near the City of Port Arthur boundary. The standard of present day urban living is based on water under pressure in the home. For this reason such a method of supply is not satisfactory.

II Alternative Supply- McIntyre Township

There are three main watercourses which flow through the Township of McIntyre. These are the Current River located at the extreme east end of the township; McVicar Creek, immediately to the east of Jumbo Gardens, and the McIntyre River which flows through the Oliver road, Central avenue area.

During part of the year there are periods of virtually no flow in McVicar Creek and very little flow in the Current and McIntyre Rivers. In order to use any of these watercourses as a public water supply it would be necessary to construct a large impounding dam. Such an impoundment of the water would likely promote aquatic growths and the need for special taste and odour control.

It could also be expected that during periods of high flow there would be considerable turbidity in the raw water. To counteract this it would be necessary to construct a complete filtration plant in order to provide a continuously satisfactory water.

It is felt that the amount and quality of water which could be developed from these different sources would not be justified by the cost. In view of this, the only dependable source of supply for this township is from either the Port Arthur or the Fort William systems.

III Water Needs- McIntyre Township

The population of the Municipality of Shuniah in 1939 and

1957 was respectively 1,987 and 4,674. The majority of this population is located in McIntyre Township. This represents an increase of 135% in 19 years. The increase has been predominantly residential with very little industry.

It should be remembered that much of the growth of the lakehead area has been based on the pulp and paper industry or grain storage and shipping. Both of these depend on access to large bodies of water, in one case for processing and transportation and in the other case for transportation only. These requirements rule out the possibility of these types of industries locating in the township.

The secondary or lighter types of industries demand some or all of the following features good transportation facilities, hydro, water and sewer services, land at a reasonable cost. At present the most desirable feature in the township is the low cost of land, but the lack of many other features makes the area unattractive to many industries at present.

Municipalities are aware that unless residential development is of the above average cost type of home the services supplied to it must be subsidized in part by the commercial and industrial taxes. For this reason residential growth in a community should be accompanied by an adequate industrial and commercial growth.

At present from the total of 8,600 acres in Port Arthur there remains some 3500 useable acres which have not been developed. This is approximately 40% of the total area. In addition there is rock close to the surface in many areas in both Port Arthur and the Township of McIntyre. This makes the laying of sewers and water mains costly. For this reason the city has passed a bylaw which prohibits new developments in an area unless these services are available or it is economical to

install them.

The future water needs of the area are difficult to determine but the above points indicate that it will be required mostly for residential and some commercial developments. On the basis of past growth a population of some 10,000 can be expected by 1980. Factors may change this rate of growth. Such a development, being mostly residential will have an average daily water demand of 1,000,000 gallons. This can be supplied from the Port Arthur system in the north and central portion of the township and possibly by the Fort William system in the south.

IV Cost of Servicing Built-Up Areas -- McIntyre Township

At the request of McIntyre Township a report was prepared on the cost of supplying Port Arthur water to certain built-up areas of the township. The report was made by D.H. Annala, Engineer for the Port Arthur Public Utilities Commission. The following is a summary of this report:

Area #1 (Jumbo Gardens) See Fig. 3

This is the most densely populated area of the four. The number of consumers involved could be 146. The estimated costs of the mains are as follows:

<u>Street</u>	<u>Length of Main</u>	<u>No. of Consumers</u>	<u>Estimated Cost</u>
John street	1,500 feet	10	\$15,000
Red River road	2,000 "	11	20,000
Dublin avenue	3,800 "	35	38,000
Strand avenue	3,700 "	41	37,000
Regina street	3,600 "	40	36,000
Picadilli avenue	3,400 "	9	34,000
	18,000 "	146	\$180,000

This area could be served from the existing city reservoir by extending the mains at the corner of Carl avenue and John street,

and Carl avenue and Red River road. The pressure at the end of the existing line is adequate, being approximately 65 lbs. per square inch when the Duke street reservoir pressure is 70 lbs. per square inch.

The main on John street could be used to service the consumers in Area 2, and if this is the case, then the cost of this portion could be carried by both areas. Similarly with the main on Red River road if it is continued further to service the other areas.

Area #2

This area lies to the north and north-west of area #1.

<u>Street</u>	<u>Length of Main</u>	<u>No. of Consumers</u>	<u>Estimated Cost</u>
John street	2,000 feet	2	20,000
Red River road	3,100 "	13	31,000
Fassina street	160 "	6	1,600
Mathews street	2,600 "	18	26,000
Mary street	2,400 "	17	24,000
East street	600 "	2	6,000
Market street	1,700 "	10	17,000
Hilldale road	500 "	4	5,000
	13,060 feet	72	\$130,600

Area #3

This area, to the west of Areas 1 and 2 would be fed off John street.

The total lengths of mains on the two roads considered is 9,500 feet, serving 54 consumers and estimated to cost \$95,000.

Area #4

This area has the least number of consumers, and the costs of mains would be prohibitive. The elevation of the area is too high for feeding from the present reservoir and would necessitate the installation of a booster pumping station.

Also the city would have to extend the mains inside the city limits approximately 1,200 feet before reaching Area 4, and this section is not opened up to receive service.

The costs used in this estimate are taken from the city of Port Arthur's experience in the past. The cost per foot of a 6" watermain installed varies from \$8.00 to \$15.00 depending on ground conditions. This report uses the figure of \$10.00 per foot as an average, since only a complete field survey of the areas would allow a more exact cost to be arrived at.

The costs considered in this report cover only the mains. All individual services from the main to the residences served would be an additional cost. This cost would vary depending on ground conditions and the length of the connection. An average cost in the city for a 100 foot water service connection is approximately \$300.00. The cost of all fire protection, which includes the cost of hydrant branches, hydrants and hydrant valves, will be additional.

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This report clearly indicates the high cost of servicing residential areas which are relatively sparsely developed. For instance in Area #1, the most densely populated section, it requires 18,000 feet of watermain to service 146 homes. If the area was completely developed, and on the basis of 70-foot lots and 10% not usable length of main, this pipe could serve some 460 homes. On this basis the average cost would be reduced from approximately \$1,200 to \$390 per lot.

The general practice in Port Arthur is to lay the sewers at the same time as the watermains. This provides for more economical construction. At present the sewage in most of the township homes is disposed of by means of septic tank systems. There is not reported pollution problem due to the operation of these private sewage systems. As areas become more densely settled and water under pressure is

available, these systems may fail to give satisfactory service. In view of this, sewers should be installed at the same time as the watermains. This would add an additional cost of approximately \$3.00 per foot. It should also be appreciated that these costs are for mains and sewers only and do not include the service connections.

V Future Development of the Area --- McIntyre Township

The desire of home builders for large inexpensive lots, focuses attention on the outlying areas. In general the land here is cheaper than in the city. However, when the cost is considered of extending watermains and sewers to these areas the land can no longer be considered as cheap. As previously discussed the amount of available ground water in this area is only suitable for supplying isolated homes. Modern day urban living is only possible when an adequate supply of water under pressure is available.

In view of the factors discussed, the municipality should give consideration to some restrictive bylaw, which would discourage residential building unless, it was economical to serve the area with water and sewers. If this is not done the problems created will later have expensive solutions. An unbiased adherence to a good general development plan should avoid this.

VI Pollution -- McIntyre Township

Most of the sewage in the township is discharged to septic tank systems and privies. In general there are no major pollution problems. However, when water under pressure is available and the housing becomes more concentrated, consideration will have to be given to public sewers and sewage treatment facilities.

The location of a central sewage treatment plant is determined

partly by the availability of a watercourse for receiving the plant effluent. The three main watercourses in the township are: Current River, McIntyre River, McVicar Creek. The downstream portions of these all flow through built-up areas of Port Arthur. There is also a large park with swimming area developed on the Current River near its mouth. In view of this, it will be necessary that these streams have a continuously adequate flow for diluting the effluent from any upstream sewage treatment plant. It is reported that there is very little flow in any of these during part of the year. Thus they are not ideal for carrying the effluent from a municipal sewage treatment plant.

Much of the drainage of the south-east portion of McIntyre Township is to the McIntyre River. This river passes close to both the Port Arthur and the proposed Fort William sewage treatment plants. In view of this a trunk sewer could be located in the valley of the McIntyre River which would serve the south-east portion of the township. It might be possible to initially serve this area by a small complete treatment sewage plant. This could only be considered as an alternative solution until such time as it was economical to construct a trunk sewer. This trunk sewer could be connected into the Fort William sewerage system. The proposed trunk sewers for Fort William have been designed to receive the flow from 1200 acres or 18,000 people from outside the city boundaries.

A trunk sewer in the McIntyre River valley could collect the sewage from the present two main built-up areas of the township, i.e., Jumbo Gardens and Oliver road, Central avenue. The logical direction for sewage flow from the area north of

Jumbo Gardens would be south and east to the Port Arthur system. The present Port Arthur sewage plans are not based on receiving any flow from outside the present city boundaries. If development occurs in the north-east portion of the township, the sewage flow from it, will most likely have to be pumped to the suggested McIntyre River trunk sewer. This will be costly, and unless an alternative solution can be arrived at the development of the north-east section of the township should be delayed until a complete engineering survey and report can be made of the area.

VII Recommendations for Water Development -- McIntyre Township

The type of development which will occur in the township, i.e., mostly residential combined with the adverse soil conditions will make water and sewer servicing expensive to the individual home owner. Because of this adequate control should be exercised over future home building. The township should pass a bylaw which would prohibit home building unless water and sewers are available.

The expected average daily water demand by 1980 will be 1,000,000 gallons. The preferred and most economical source for this water will be from the Port Arthur and Fort William systems. With this in mind a basic water agreement should be reached with these two cities.

VIII Recommendations for Pollution Control -- McIntyre Township

In order for the township to grow and have concentrated centres of population it will eventually be necessary to have a public sewerage system. As none of the township watercourse is ideal for receiving the effluent from a sewage treatment plant, it will ultimately be necessary to direct this flow toward the Fort William

and possibly the Port Arthur systems. The township should reach a basic sewage agreement with the two cities.

The sewage flow from the south-east portion of the township including Jumbo Gardens should be directed toward the McIntyre River. A trunk sewer should be laid which in general would follow the valley of the McIntyre River. This trunk would be connected into the Fort William system. A temporary measure might be the construction of a small complete sewage treatment plant in this area.

If the proposed Port Arthur sewerage system can be adjusted and an agreement reached, then sewage from the east section of the township north of Jumbo Gardens, should be directed south to the city sewers. The alternative to this would most likely be to pump this sewage to the suggested McIntyre River.trunk sewer. The cost of such an alternative should be considered if and when requests are made for the development of the north-east part of the township.

MUNICIPALITY OF NEEBING

I Water Supply

The Municipality of Neebing contains the geographical townships of Blake, Crooks, Pardee and Neebing. Most of the concentrated population is located in Neebing Township. The water supply for the municipality is obtained from wells, both dug and drilled. Surface water, where it is available is used for supplying livestock. Water is also supplied to some areas from the Fort William system.

Ground water supply in this area is limited. During the summer many of the wells go dry. This problem was especially prevalent in 1958. Many persons have had to construct deeper wells or try different locations in search for more water.

In the Township of Neebing water shortage problems have been experienced with many of the wells. Some of the areas where wells have gone dry are as follows; at the east end of Arthur street, Broadway west of Victor street and on Victor street. The Fort William Industrial Farm has not been able to locate an adequate supply of water.

Water from the Fort William system is supplied to some sections in the Township of Neebing. There are approximately 50 homes in the Stanley Park area supplied by a 2-inch diameter line. This development is on Arthur street at the boundary of Neebing Township and Fort William. At the extreme east end of Rosslyn road, six homes and the Neebing municipal building receive water from the city. A 4-inch cast iron city water main extends some 4,000 feet west along Broadway to supply the Mountain View Cemetery. The airport which is located between Rosslyn road and Arthur street is supplied by city water via an 8-inch main and a 6-inch main. The longest main in

Neebing Township is some two miles of 6-inch pipe which supplies the Canadian National Railway yards. In addition the Great Lakes Paper Company Limited, located at the east end of Broadway, is connected to the city system by a 10-inch diameter main.

II Alternative Water Supply -- Neebing Township

As discussed for Fort William the Kaministikwia River would be a good source for municipal water. The township could consider the eventual construction of a water treatment plant using this river as the source. However, the Fort William distribution system is extended, for the most part to the western boundary of the townships, and if a satisfactory agreement can be reached between the the two parties a joint water development system would be more economical and desirable.

III Water Needs -- Neebing Township

Most of the development in the Township of Neebing has been residential housing. The exception to this is the Great Lakes Paper Company Limited and the Lakehead Airport. The area of greatest development is between the Kaministikwia and Neebing Rivers. This section contains the Airport, the Great Lakes Paper plant and is served by the main railroad lines. The Kaministikwia River is navigable to Point de Meuron.

Much of the industrial activity in the Lakehead is dependent on shipping. The Kaministikwia River is navigable for some five water miles in the township. As dock room in Port Arthur and Fort William becomes more critical the river front in the township will be in greater demand. This area will also be suitable for industries which are large water users. At the same time it should

be noted that there is over 4,000 acres of available industrial land in Port Arthur and Fort William. Much of this is on or near the waterfront. In view of its proximity to existing industries it is felt that much of this will be used before there is extensive development of the available industrial property in the township.

The present population of the township is 3,530. The population of the Municipality of Neebing in the years 1939 and 1958 was 1,829 and 4,254, respectively. This represents an increase of 132% in 20 years. Using this same percentage increase for estimation purposes, the population for Neebing Township in 1980 will be 8,500. The anticipated average daily water consumption with this population would be approximately 900,000 gallons, which is exclusive of the demand by the Great Lakes Paper Company. This could be the basis of designing a complete water distribution system.

IV Water Servicing Cost for Present Developments -- Neebing Township

The average cost of laying watermains in this area is much less than for Port Arthur or the Municipality of Shuniah. This is due to the general flat grade of the area, and the fact that rock is not frequently encountered in the trenching operations.

Estimates have been made for laying watermains from the Fort William distribution system to the three most populated areas in the township. It should be appreciated that these costs are made without the knowledge of actual ground conditions which will be encountered. A detailed study might indicate the need for laying a large diameter feeder main from a more central point in the city distribution system. This would be in order to maintain a satisfactory quantity and pressure in the proposed township mains. The basis

for the costs is \$8.50 per foot for 10-inch diameter water main, \$7.00 per foot for 8-inch and \$5.50 for 6-inch.

Plan #1

This plan would provide water for Rosslyn road and Broadway from Neebing avenue (Fort William, Neebing Township boundary) on the east to a westerly point which would be in line with the west boundary of the Fort William Heights Plan #255 or point "A" on figure 3. Mains would also be installed on the more populated streets which cross or abut on Rosslyn road and Broadway.

The following side streets on Rosslyn road would have mains:

- Glendale Rd.) with a loop at C.P.R. tracks
Lynda Ave.)

- Empson Ave.) looped near end
Unknown St.)
Pipe Av.)

- The street which forms the east boundary of Fort William Heights Plan #255 to point "B" then west along this street to the end of plan.

The following side streets on Broadway would be serviced:

- Street north of Broadway passing through centre of Plan #693.

- Victor street, north and south of Broadway.

- Streets bordering Glendale Park.

- Streets bordering Plan #704 and looped near end.

A 10-inch diameter main would be laid along Broadway and an 8-inch along Rosslyn road and in the loop joining them at the west end. The mains laid on the side streets would be 6-inch diameter.

This plan would serve some 400 homes and cost \$430,000. On the basis of the present number of homes the cost would average \$1075 per house. Some 63,500 feet of 10-inch, 8-inch and 6-inch

diameter pipe would be laid. Allowing 70 foot widths for each house and 10% for street crossings and non-usable portions of main, this would provide for some 1600 homes, that is housing on both sides of street. On this basis the ultimate average cost for this plan could be \$270 per home. There would be an additional charge for laying service lines from the mains to the houses.

The total cost for the present number of homes is high, and a stage development of the overall plan should be considered. The initial stage of the plan would be the laying of the 10-inch diameter main along Broadway from Neebing avenue to the Glendale Park area. At this point it could be looped into the existing 6-inch main which supplies the Canadian National Railway yards. This stage would serve some 215 homes and cost approximately \$136,000. Additions could be made to the system as more homes are built in the area.

Plan #2

This plan would provide water for the Arthur street area. Initially the main would be along Arthur street from Neebing avenue to Neebing River crossing. This street is part of the Trans-Canada Highway, and the type of development is difficult to predict. However, it is felt that much of it will be commercial. At present there are some 50 homes in the Stanley Park area which is located at Arthur street and Neebing avenue. As previously discussed this area is served by a two-inch diameter pipe from the city distribution system. It is felt that an estimate of cost to serve the area at this time would be premature.

As noted there is a water shortage problem at the Fort William Industrial Farm. The Farm is located on Highway #61 in the south-west corner of the Township of Neebing. (See figure 2) There is only

a sparse development along the Highway, and the Farm is some five miles from the nearest watermain. In view of this it is not economically feasible at this time to serve the Industrial Farm with city water. There is no adequate supply of surface water in the area which could be economically developed. It is believed that the only reasonable avenue of investigation would be an intensive geological study of the area with a view to developing ground water.

The foregoing indicates the high cost of providing water service to residential developments which are spread out. This points to the need for controlling future residential development in the area. To do this the township should pass a bylaw which would prohibit home-building unless water and sewers are available or can be economically installed.

V Pollution -- Neebing Township

The sewage from homes in the township is treated in private individual systems such as septic tanks and privies. On the whole these systems have functioned satisfactorily. However, as the population becomes more concentrated, consideration will have to be given to providing a public sewerage system.

The preferred method of treating sewage from the township would be in the proposed Fort William sewage treatment plant. However, if this is not possible consideration will have to be given to the eventual construction of a township sewage treatment plant.

In the built-up area between the Kaministiquia and Neebing Rivers most of the drainage is toward the Neebing River. This would normally be the logical watercourse for the location of a sewage treatment plant. However, due to the very low summer flows in the Neebing River and the fact that there are large built-up areas

downstream, an effluent going into this watercourse would not be desirable.

It is believed that the sewage from the south part of this section should be directed toward the Kaministikwia River. A township sewage treatment plant could be located on this river near the west boundary of Fort William. The sewage from the north part of this section and the area north of the Neebing River should if possible be discharged to the Fort William system. If this is not possible the alternative would be to pump it to the suggested township sewage treatment plant on the Kaministikwia River. Such an alternative would in all probability be more costly than connecting this area to the Fort William system.

The only industrial waste in Neebing Township which would require special consideration is that from the Great Lakes Paper Company. This has previously been discussed under "Fort William". This order of presentation was adopted in view of the fact that pollution from this company affects the city more than the township.

VI Recommendations for Water Development -- Neebing Township

A satisfactory water supply for the township can be secured from the Kaministikwia River, but it is recommended that the township enter a joint water development programme with the City of Fort William.

The township should pass a bylaw which would prohibit housing developments unless watermains and sewers are available or can be economically installed.

A township water distribution system should be constructed. The initial area to be served would be Broadway and Rosslyn road.

VII Recommendations for Pollution Control -- Neebing Township

Plans should now be made for a public sewerage system, which will be necessary if Neebing Township is to grow. The preferred objective for the township would be to discharge all sewage to the proposed Fort William sewage treatment plant. If this is not possible consideration should be given to the construction of a sewage treatment plant on the Kaministikwia River near the east boundary of the township. This plant could receive all sewage from the township or only from the south part of the area between the Kaministikwia and Neebing Rivers. This would depend on whether or not an agreement can be reached between Fort William and the township.

TOWNSHIP OF PAIPOONGE

The only built-up area in the Township of Paipoonge is Rosslyn Village. The village is located on the north bank of the Kaministikwia River about 10 miles west of Fort William. It has a population of 200, and the main industry is a brick yard.

Most of the homes have private dug wells and septic tank systems. Much of the area contains gravelly soil and the wells and sewage disposal systems operate satisfactorily. There is some concern over the possibility of the wells becoming contaminated by the proximity of many of the septic tank tile beds.

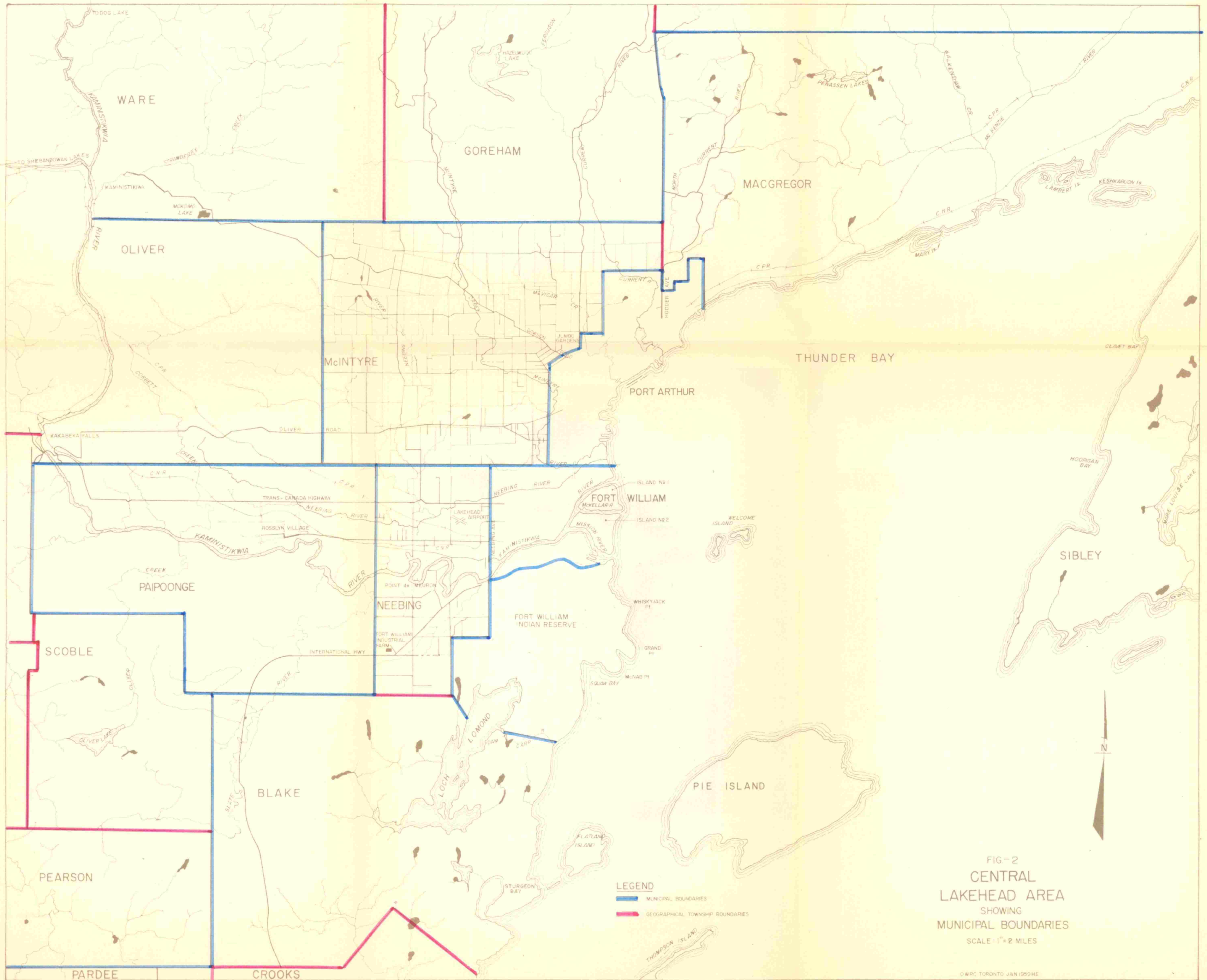
The local health unit is aware of this possibility, and regular samples are obtained from the wells. These samples, on the whole have been satisfactory. However, if it is found necessary to adopt some other method of sewage disposal an oxidation lagoon could be constructed.

Oxidation lagoons for small municipalities are economical to construct and operate. The main points in such an undertaking would be a suitable location and a satisfactory watercourse for receiving the lagoon effluent. The Kaministikwia River would not be suitable for receiving such a discharge in view of the fact that it might be used as a source of water supply for Fort William. If drainage will permit the nearby Neebing River would be the preferable watercourse for receiving the effluent from any sewage treatment system.

TOWNSHIP OF OLIVER

The Township of Oliver has a population of 1,157 with its two main areas of development at Kakabeka Falls and Murillo. Murillo is an old mining area and the population has become static. Kakabeka Falls contains a hydro plant and small village. It has some potential growth development as a tourist centre.

There are some cases of water shortage in private wells but the sparse population would make uneconomical the development of a public water or sewage system.



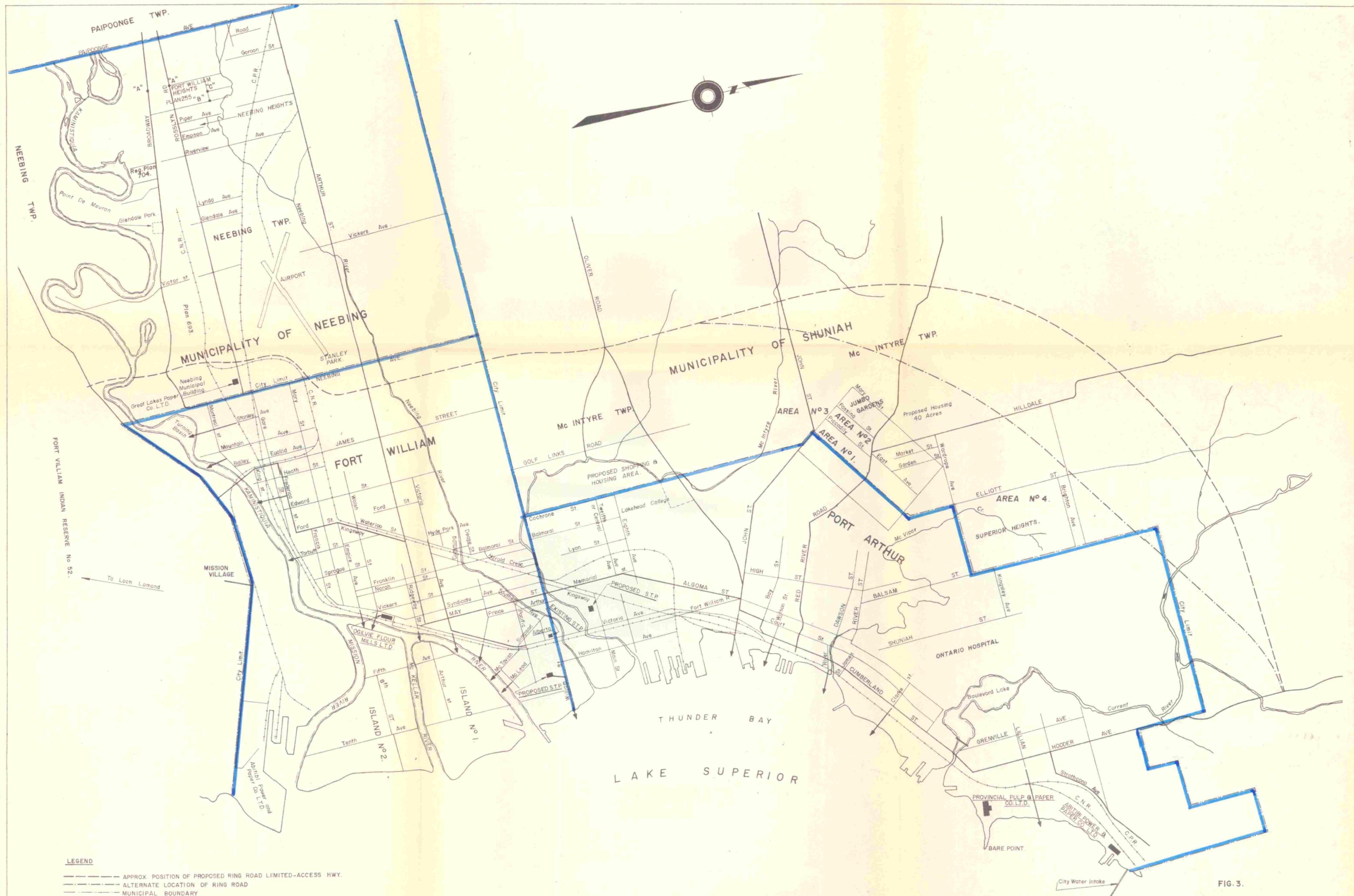


FIG. 3.
CENTRAL LAKEHEAD
DRAINAGE & DEVELOPMENT AREAS

0 2000' 4000' 6000' 8000'

OWRC, TORONTO, February 1959. S.H.